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Experimental Analysis of an 802.11b Wireless Mesh Network

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Abstract

Wireless Mesh Networks (WMNs) are a type of radio-based network which require minimal configuration and infrastructure. They can be built using relatively low cost radio and computing platforms. In this paper we attempt to analyze the performance of a simple WMN using various packet sizes as well as a multi-hop WMN.

1. Introduction

Wireless Mesh Networks are a type of radio based network which require minimal configuration and infrastructure. Networks created using this technology are intended to be decentralized, low cost and resilient.

In such networks nodes provide identical functionality and communicate with neighbouring nodes in order to exchange routing information and forward data packets. Nodes exchanges information only with their neighbours, therefore, coverage of the network depends on the underlying radio technology, number of nodes and location in relation to each other.

Mesh networks have potential for reliability because they follow a completely decentralised approach. When a single node goes down its neighbours simply find another route around it.

Also, mesh technology finds many applications in wireless multi-player gaming, building automation, campus connectivity, military communication, municipal networks, etc.

2. Method

Mesh nodes in our experimental setup consisted of a Soekris Box net4521, 100/133 MHz AMD processor. Each Soekris Box runs under Pebble Linux installed on compact flash. The wireless PC cards used are Netgear WAG511 with Aetheros chip set using the latest version of the Mad WiFi drivers. A Dell Optiplex GX210 (running Linux, Fedora Core 4), was used as a wireless sink to collect data.

UDP traffic was generated using the MGEN traffic generator. Four packet sizes were chosen, namely 1472, 1024, 512 and 64 bytes. Packets rates were increased by 10 packets per second (pps) at intervals of 5 seconds up to saturation. Data gathered included throughput, pps and loss. IP forwarding was set on each node and the transmission rate was set to 11Mbps.

The basic concept was to study the effects of throughput as the number of nodes and packet size increased.

3. Results

When analyzing our single hop network the results obtained are similar to those found when using a client in infrastructure mode. However, the results show an appreciable decrease in the achievable throughput as the number of hops is increased. For a large packet size of 1472 bytes, the throughput obtained decreases from 7 Mbps on a single hop to approximately 1.5 Mbps for 5 hops. Similarly for a small packet size of 64 bytes, throughput decreases from 1.5 Mbps (single hop) to approximately 0.3 Mbps (5 hops). The effect of increasing the number of hops is also seen in the achievable packet rate. Packet loss was negligible with most occurrences at saturation.

4. Conclusion

Analysis shows that while wireless mesh networks are relatively simple to extend we must be aware of the consequences and trade offs. Clearly if such networks are to be deployed, careful consideration will have to put into routing algorithms used so as to obtain higher throughputs. Another option may be to use multiple radios for client access and backhaul.